Chapter 11 Worksheet

The following molecules are gases at room temperature: Ne, N_2, O_2, Cl_2, and SiH_4. Which one will have the highest boiling point?

a) Ne b) N_2 c) O_2 d) Cl_2 e) SiH_4

Ideally, collligative properties depend only on

a) the identity of the solute in a solution.
b) the number of solute particles per solvent molecule in a solution.
c) the temperature of a solution.
d) the charge of the ions dissolved in solution.
e) the gas pressure above the surface of a solution.

What is the molality of Na^+ ions in a 6.29% by mass Na_2CO_3 solution? The molar mass of sodium carbonate is 105.99 g/mol.

a) 0.134 *m* b) 0.593 *m* c) 1.04 *m* d) 1.19 *m* e) 1.27 *m*

Concentrated sulfuric acid is 18.0 M and 96.0% H_2SO_4 by mass. What is the density of concentrated sulfuric acid?

a) 0.825 g/mL b) 0.960 g/mL c) 1.37 g/mL d) 1.77 g/mL e) 1.84 g/mL

The Henry's law constant for N_2 in water at 25 °C is 8.4×10^{-7} M/mm Hg. What is the equilibrium concentration of N_2 in water when the partial pressure of N_2 is 653 mm Hg?

a) 1.3×10^{-9} M b) 7.2×10^{-7} M c) 5.5×10^{-4} M d) 3.1×10^{-2} M e) 7.8×10^{8} M

Which of the following aqueous solutions should have the lowest freezing point?

a) pure H_2O b) 1 *m* $CaBr_2$ c) 1 *m* NH_3 d) 1 *m* $NaNO_3$ e) 1 *m* $C_6H_{12}O_6$

What is the freezing point of a solution containing 5.663 grams naphthalene (molar mass = 128.2 g/mol) dissolved in 32.0 grams paradichlorobenzene? The freezing point of pure paradichlorobenzene is 53.0 °C and the freezing point depression constant, K_{fp}, is –7.10 °C/*m*.

a) 43.2 °C b) 47.0 °C c) 51.7 °C d) 53.0 °C e) 69.1 °C

What mass of NaCl must be dissolved in 75.0 grams of water to lower the freezing point to –4.00 °C? The freezing point depression constant, K_{fp}, for water is –1.86 °C/*m*. Assume the van't Hoff factor for NaCl is 2.00.

a) 1.02 g b) 2.04 g c) 2.35 g d) 4.71 g e) 9.43 g

Which of the following is an example of osmotic pressure?
a) salting icy roads
b) salting meats for preservation
c) pressurizing soda with carbon dioxide
d) mixing water and ethylene glycol in anti-freeze
e) distilling alcohol

A solution is prepared by mixing 0.0300 mols of CH_2Cl_2 and 0.0500 mols of CH_2Br_2 at 25°C. Assuming the solution is ideal; calculate the composition of the vapor (in terms of mole fractions) at 25°C. At 25°C, the vapor pressures of pure CH_2Cl_2 and pure CH_2Br_2 are 133 and 11.4 torr, respectively. (#50)

An unknown compound contains C, H, and O. Combustion analysis of the compounds gives mass % of: 31.57% C and 5.30% H. The molar mass is determined by measuring the freezing point of -5.20°C is recorded for a solution made by dissolving 10.56 g of the compound in 25.0 g water. Determine the empirical formula, molar mass, and molecular formula of the compound. Assume that the compound is a nonelectrolyte. (#83)

A solid mixture contains $MgCl_2$ and NaCl. When 0.5000 g of this solid is dissolved in enough water to form 1.000 L of solution, the osmotic pressure at 25.0°C is observed to be 0.3950 atm. What is the mass % of $MgCl_2$ in the solid? Assume ideal behavior. (#90)

Na_2CO_3 6.29% mass.

100 g total = solute + solvent

6.29 g of Na_2CO_3 → 0.0593 mols

93.71 g H_2O

$$\frac{0.1187 \text{ mols } Na^+}{0.09371 \text{ kg}} = 1.27$$

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18 M H_2SO_4

$$d = \frac{\text{Mass}}{\text{Vol.}}$$

96% H_2SO_4

100 g total

96 g H_2SO_4

4 g Solvent

18 M =

1 L of solution

18 mols H_2SO_4

↳ 1764 g/mol

$$\frac{96}{100} = \frac{1764}{x}$$

$$x = 1837.5 \text{ g}$$

$$d = \frac{1837.5 \text{ g}}{1000 \text{ mL}} =$$

1.8375 g/mL

$S = P \cdot k_H$

$S = (653)(8.4 \times 10^{-7})$

$S = 5.5 \times 10^{-4}\ M$

B because more ions

$\Delta T = k \cdot m \cdot i$

$\frac{0.0442 \text{ mols}}{0.032}$ $i = 1.38$

$\Delta T = (-7.10)(1.38) = -9.8$

$53 - 9.8 = 43.2$

$\Delta T = K \cdot m \cdot i$

$-4 = (-1.86)(m)(2)$

$m = 1.075$

$1.075 = m = \frac{x}{0.075}$

$x = 0.0806$ mols

$\hookrightarrow \times 58\ g/mol = 4.7\ g$

B because it must remove the H_2O to preserve

0.0300 mols CH_2Cl_2 } solution
0.0500 mols CH_2Br_2 }

∴ χ	P (vapor)
0.375 CH_2Cl_2	49.875
0.625 CH_2Br_2	7.125

$P = \chi \cdot P^{\circ}$

$\frac{49.875}{57} = 0.875 = X_{CH_2Cl_2}$

$X_{CH_2Br_2} = 0.125$

%	mols
31.57 C	2.63
5.30 H	5.30
63.13 O	3.96

$CH_2O_{1.5}$ } E.F.

$C_2H_4O_3$

↳ 76 g/mol

$\Delta T = k \cdot m \cdot i$

$-5.20 = -1.86\ m$

$m = 2.80 = \frac{\text{mols Solute}}{\text{Kg Solve}} = \frac{X}{0.025\ kg}$

$X = 0.0699$ mols

$\frac{10.56\ g}{0.0699\ \text{mols}} = 151\ g/mol = M.W.$

$C_4H_8O_6$

$\pi = cRT \cdot i$

$0.3950 = c(0.082057)(298)$

$c = 0.0162\ M$

$\therefore\ 0.0162$ mols

$$0.0162 \text{ mols} = \frac{3X}{95.21} + \frac{2Y}{58.44}$$

$X + Y = 0.500\ g$

$X = 0.50 - Y$

$$0.0162 = \frac{1.5 - 3Y}{95.21} + \frac{2Y}{58.44}$$

$$0.0162 = \frac{87.66 - 175.32Y + 190.42Y}{5564.0724}$$

$2.477 = 15.1Y$

$Y = 0.164\ g\ (NaCl)$

$\therefore\ 0.336\ g\ MgCl_2$

$$\frac{0.336\ g}{0.50} \times 100 = 67.2\%$$